



ABBE MARK III

REFRACTOMETER

USER GUIDE

Introduction

Congratulations on the purchase of your new Reichert Mark III transmitted light refractometer.

This manual describes the proper operation and care of this state of the art instrument. The purpose of this instrument is to aid quality control personnel in food and beverage, medical, pharmaceutical, industrial fluids, chemical and petrochemical applications. The Mark III's simple, yet advanced features, make it a well suited and widely used instrument.

The Mark III refractometer is a high precision optical instrument. To obtain the best possible accuracy, it is absolutely necessary to maintain the instrument. The precision and accuracy of a refractive index measurement is largely dependent upon operator skill, cleaning practices, temperature control, accuracy of calibration standards, chemical stability and the physical characteristics of the sample. Use of good laboratory practice is essential. Reichert recommends that daily calibration with distilled water be performed as a minimum requirement. To assure the longest life of your Mark III, always store the instrument with the prism surfaces and instrument clean and dry to prevent premature failure of the prisms and seals due to any harmful effects from sample residue.

The instrument is programmed to read out directly the refractive Index, percent solids and the temperature of samples. The percent solids scale is based upon the ICUMSA conversion tables relating refractive index to percent solids concentration for sucrose solutions. For non-sucrose solutions, they may be read directly in the refractive index mode (non-temperature corrected), or in the percent solids mode provided that the conversion value is known.

For product specific measurement, custom channels also may be programmed into the Mark III. Custom channels allow the instrument to read out directly in refractive index or percent solids temperature compensated values. For more information regarding custom channel programming, contact Reichert Analytical Instruments Technical Service.

Product Registration

Please visit our web site at www.reichert.com to register your new Refractometer. Click on Analytical Instruments, Support, Register your Reichert product.

In doing so Reichert Analytical Instruments will be able to provide you with technical support and information updates as they become available.



Table of Contents

Preliminary Information	Table of Contents	1
	Warnings and Cautions	2
	Symbol Information	2
Features and Requirements	Environmental Conditions	3
	Electrical Ratings/Specifications	3
	Instrument Features	4
Sample Analysis (Quick Start)	Set Up	5
	Sample Analysis	5
Operation	Measuring Solid Samples	6
	Menu Options Overview	6
	Calibration	7
	Set Point Calibration	7
	Span Point Calibration	7
	Editing Calibration Points	8
Operational Parameters	Sample Temperature Effects on Readings	8
	Automatic Temperature Correction (TC)	8
	Computer Interface	9
	Printer Interface	9
	Custom Channel Activation	10
	Uploading Custom Channels	10
	Menu Options	11
	Water Bath Attachment	13
Maintenance	Care and Cleaning	14
	Cleaning Precautions	14
Accessories	Printers	15
	Fuse	15
	Calibration Oil	15
	Bromonapthalene	15
Warranty	Warranty and Non-Warranty Service	15

Warnings and Cautions

Caution: In order to insure that correct operation of the Mark III instrument is maintained, any repair or service must be performed by experienced personnel that are trained by Reichert Inc.

Caution ESDS: The internal circuitry of the Mark III contains electrostatic discharge sensitive devices (ESDS). Such components may be sensitive to high voltages produced by static discharge.

Caution: Do not use strong solvents or strong cleaning solutions on any part of the Mark III or damage to the unit may occur.

Warning: Do not remove or defeat the earth ground connection on the Mark III power input connector or the unit's power cord. Damage to the Mark III instrument and/or injury to the operator may occur.

Warning: The Mark III should be used in strict accordance with the instructions outlined in this users guide. The safety of the operator and the performance of the instrument cannot be guaranteed if used in a manner not specified by Reichert Inc.

Symbol Information

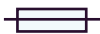
The following symbols appear on the instrument.



CAUTION: Risk of Electrical Shock



CAUTION: Indicates that important operating and maintenance instructions are included in this user guide



CAUTION: Replace with the same type and rating fuse



Date of Manufacture



Waste of Electrical and Electronic Equipment

SN

Serial Number

[REF]

Catalog Number



Ground



On - Off



Conformity with mandatory European safety requirements

Environmental Conditions

- Indoor use only
- Operating temperature range: 10°C - 80°C
- Maximum relative humidity: 80% for temperature up to 31°C decreasing linearly to 50% (relative humidity at 40°C)
- Installation category II (over voltage category)
- Pollution degree 2
- Altitude up to 2,000 meters

Electrical Ratings/Specifications

The Reichert Mark III refractometer incorporates an auto sensing, switching AC power supply. Never use an adapter between the power cord and the power source which will interrupt the protective grounding.



- **Caution:** Risk of electrical shock exists if any cover of the Mark III is removed. Hazardous voltages will be exposed which can cause injury or death. Refer servicing to a Reichert trained service technician.
- **Supply Voltage:** 100 - 240VAC 50/60HZ.
- **Fuse Rating:** 800mA, 250V, 5x20mm.
- **Power Cords:** US, EU, UK supplied.
- **Dimensions:** 11" L x 6.25" W x 13.75" H (280 mm x 258 mm x 345 mm).
- **Net Weight :** 17.25 pounds (7.84 kg).
- **Display:** LCD, 1.85" W x 1.85" H (47 mm x 47 mm).
- **Illumination:** Six high intensity LED's.
- **Prism Assembly:** Stainless steel assembly with glass prisms.
- **Range, Channel 1:** 1.3000 - 1.7000 nD; 0 - 95% Brix per ICUMSA.
- **Readability:** 0.0001 nD; 0.1% Brix.
- **Precision:** +/- 0.0001 nD; 0.1% Brix.
- **Channel Options:** Channel 1 Refractive index, Brix (Sucrose, ICUMSA)
Channel 2 - 15 User defined (Numerous scales available)
- **Temperature Compensation Range:**
10° - 40°C.
- **Sample Types:** Transparent and translucent liquids or solids.
- **Sample Temperature Control:**
Water bath circulator ports on upper and lower prism assemblies.
- **Data Output:** Two 9 pin RS232 serial ports.

Instrument Features



Calibration Oil

Set Up

- Unpack the instrument from shipping carton. Retain packing material for future storage/protection/shipping.
- Place the instrument indoors on a solid surface in an environment where the temperature is stable. Be certain that the instrument is not subjected to direct discharge from heating or air conditioning vents, or water bath circulator exhaust. Drafts can have an adverse affect on temperature stability.
- Insert the appropriate plug end into the power receptacle located on the underside of the instrument. Plug the opposite end of the power cord into a receptacle to supply the instrument

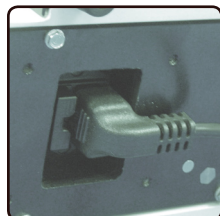


Fig 1

with power (Fig 1). Supply voltage: 100 - 240VAC 50/60HZ.

- Turn the instrument on by activating the power switch located on the right side cover (Fig 2).
- Allow the instrument to reach a stable operating temperature in the on position for a minimum of one hour before attempting calibration or to measure samples.



Fig 2

Sample Analysis

Cleanliness, sample temperature equilibration and shadowline clarity is essential to obtain the greatest possible accuracy from the Mark III refractometer. Highly viscous samples or samples that contain trapped air bubbles may not produce a sharp shadowline. In these cases, applying the sample with a rubber spatula to squeeze out trapped bubbles or lifting the upper prism several times to remove the trapped air is required. The following are the required steps to properly analyze a sample:

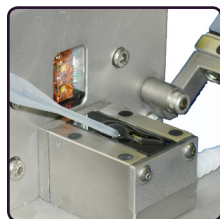


Fig 3

Raise the upper prism and apply the sample to a clean measuring surface (Fig 3).

Gently lower the upper prism to spread the sample evenly and to eliminate trapped air bubbles (Fig 4).

Allow the sample to reach temperature equilibration with the instrument.



Fig 4

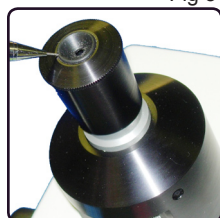


Fig 5

View the image through the focusing eyepiece (Fig 5). If required, rotate the eyepiece to bring the image of the "X" pattern into focus.

If a non-distinct shadowline containing color is viewed, rotate the color dispersion correction wheel to eliminate or reduce the color dispersion (Fig 6). Under optimal conditions, the shadowline area will appear to be sharp and black with a bright area above.

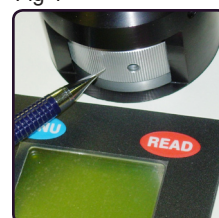


Fig 6

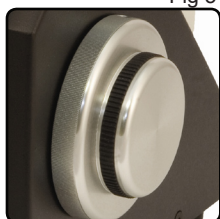


Fig 7

While viewing the image, center the shadowline in the "X" pattern by rotating the shadowline adjustment knob (Fig 7). For measuring consistency, always approach the center of the "X" pattern with the shadowline from below. Once the image has been centered (Fig 8) press **READ**.

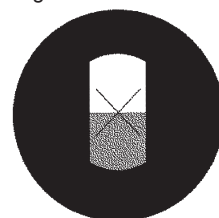
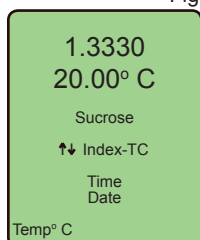


Fig 8



To the left is a representation of a displayed value. To change reading mode, press either  or  to advance through all available mode options.

Measuring Solid Samples

The Mark III is capable of measuring transparent or translucent plastic or glass solid samples with the upper prism raised. The instrument can also be used to measure very thin pliable solids, such as contact lens material, that can fit between the prisms when closed.

Solid samples must be shaped and polished correctly in order to be read. The size of solid samples should be no larger than 35mm Long x 12mm Wide x and a minimum of 2mm High. Also one side of the sample and one of the perpendicular surfaces that will face the illumination source, must be polished. All other sides should be frosted for best results.

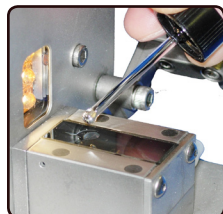


Fig 9

To measure a solid sample, apply a drop of a suitable contact fluid that has a higher refractive index value than the sample being read (Fig 9). Reichert recommends Bromonaphthalene for any solid that will not be adversely affected by this liquid.

Place the polished side of the solid sample down on the contact fluid avoiding air bubbles from being trapped in the process. Also place the polished perpendicular side toward the light source of the Mark III (Fig 10).

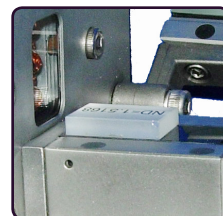


Fig 10

To complete the measurement process, follow the procedure outlined in the section “**Sample Analysis**”.

Note: Do not lower the upper illumination prism onto a solid sample as it may cause damage to the instrument.

Menu Options Overview

Shown below are the menu options as they appear on the instruments display. While many of these options are not required to operate the instrument, they have been made available to enhance the functionality of the Mark III refractometer. To access the menu options screen, press the **MENU** key.

To select an option, press the **↓** or **↑** keys to advance to and highlight the desired option. Press the **SELECT** key to enter and view the sub menu options. Using the **↓** and **↑** keys, scroll through the option choices and press **SELECT** when the desired selection is highlighted.

- Menu Options

 - Calibrate
 - Channel 1
 - Sucrose
 - Mode
 - Index-TC
 - Language
 - Auto Temp. Equil.
 - +/-0.04° C
 - Password
 - RS232 Baud
 - Time
 - Date
 - Contrast
 - ID

Calibration

To properly maintain the accuracy of the Mark III refractometer, calibration of the instrument on a routine basis is recommended. Prior to calibration, it is extremely important to completely clean the prism surfaces so no sample residue is present. Any residue on the prism surfaces will adversely affect the accuracy of the calibration.

Calibration options are either Set Point or Span Point. Set Point calibration is performed using distilled water as the calibration standard. Reichert recommends performing the Set Point calibration daily. Span Point calibration is performed with distilled water and up to 6 additional calibration standards. It is not essential to calibrate at every available point. Span Point calibration with distilled water and at least one calibration standard is recommended to ensure accuracy across the reading range of the instrument. Span Point calibration standards can be chosen to closely match the reading range of the product being analyzed.

Set Point Calibration

1.33299
Distilled Water
Position shadowline
on center of
"X" in reticle.
Press READ when ready
or SELECT to cancel
Temp° C

- Advance to the Calibration, Adjust Set Point menu option, and press **SELECT**.
- Apply distilled water as the calibration standard, as described under Sample Analysis, and allow to equilibrate to the instrument temperature.
- Adjust shadowline to the center of the "X" pattern and press **READ** to calibrate or **SELECT** to cancel.
- Upon completion the display will revert to the Calibrate menu option screen.
- Press **MENU** to return to the reading mode.

Menu Options
- Calibrate
- Adjust Set Point
- Adjust Span Point
- Advanced Options
- Exit

Span Point Calibration

The Span Point calibration option allows for up to six additional calibration points. These points can be chosen to either calibrate across the entire reading range of the instrument, or to closely match a specific range where samples are typically read. The instrument does not have to be calibrated at every available point. If you have specific requirements, Reichert offers NIST certified calibration fluids as an accessory to this instrument. One bottle of NIST certified calibration oil, catalog number 13K41330 is included with the instrument.

Note: Prior to performing the Span Point Calibration process, Set Point Calibration must be completed.

Span Calibration
* 1.40235
* 1.45746
- 1.48989
- 1.51432
- 1.57230
- 1.63039
Continue
Exit
* = Active
- = Inactive
↑↓ to choose
SELECT to toggle

- Advance to the Calibration, Adjust Span Point menu option, and press **SELECT**.
- Follow the displayed instruction to either activate or inactivate a calibration point. Points preceded by * are active and those preceded by - are inactive. The choice of these points are dictated by which calibration standards are available at the time of calibration.
- Proceed with the calibration process by advancing to Continue on the display screen and pressing **SELECT**.
- As the active calibration values are displayed, add that calibration fluid and allow to temperature equilibrate. Position the shadowline on the center of the "X" pattern and press **READ** to calibrate or **SELECT** to cancel. Promptly clean the calibration fluid from the instrument to remove all residue.
- The above step will be repeated until all active points are calibrated.
- After the last active point has been calibrated the display will return to the Calibrate option screen.
- Advance to Exit and press **SELECT**.
- Press **MENU** to return to the reading mode.

Menu Options
- Calibrate
- Adjust Set Point
- Adjust Span Point
- Advanced Options
- Exit

1.40235
Position shadowline
on center of
"X" in reticle.
Press READ when ready
or SELECT to cancel
Temp° C

Menu Options
- Calibrate
- Adjust Set Point
- Adjust Span Point
- Advanced Options
- Exit

Editing Calibration Points

Calibration fluid values may change from one lot number to the next. It is also possible to use alternate fluids to calibrate this instrument. As a result, it will become necessary to edit the stored values to match any new calibration standard.

Edit data

Point 1 1.33299
Point 2 1.40235
Point 3 1.45746
Point 4 1.48989
Point 5 1.51432
Point 6 1.57230
Point 7 1.63039
Exit

↑↓ to choose
Press SELECT to
Continue.

- To edit a value, select Calibrate, Advanced Options and press **SELECT**.
- Under Advanced Options select Edit Data and press **SELECT**.
- Follow the displayed instructions to select a stored value and press **SELECT**. The value chosen, should be the closest value to the new standard.
- Use the **↓** and **↑** keys to edit the highlighted value, and the **READ** key to advance. All three values must be updated to match the new standard or improper calibration will result. Press **SELECT** to exit.
- Before the altered value is stored, a "Save these values" screen will appear. Use the **↓** or **↑** keys to select either Yes or No and press **SELECT** to continue.
- To return to the calibration menu options screen, or the reading mode, follow the displayed choices to exit.

Menu Options

- Calibrate
- Adjust Set Point
- Adjust Span Point
- Advanced Options
- Exit

Menu Options

- Calibrate
- Adjust Set Point
- Adjust Span
- Edit Data
- Restore Factory
- Exit

Edit data

Index
1.40235

Temp Coefficient
-0.000389

Reference Temp
25.00

Use ↑ ↓, READ
to advance, SELECT
to exit

Save these values?

1.40236
-0.000398
25.00

Yes
No

Press SELECT to
Continue.

Sample Temperature Effects on Readings

Refractive Index is a physical property of a material. Refractive index measurements, and the percent solids results derived from them, are very dependent upon temperature. For most samples, raising the temperature will lower the refractive index of a sample. Conversely, lowering the sample temperature will raise the refractive index. This change in refractive index, due to a change in temperature, will cause an apparent change in concentration unless the reading is temperature corrected (TC). Before a sample measurement can be temperature corrected however, the sample needs to reach thermal equilibrium with the instrument. Without temperature equilibration, the resulting value cannot be considered accurate for direct read values or temperature corrected (TC) values. This is the result of the sample being in a state of thermal transition while the refractive index value is captured by the instrument. This is common with all refractometers.

Automatic Temperature Correction (TC)

Automatic Temperature Correction (TC) is based upon three factors, refractive index, temperature and temperature coefficient. The relationship of these three factors are used to mathematically correct a value as though it was read at a specific temperature. The most common temperature corrected (TC) temperature is 20 degrees C but it can differ with individual requirements. The temperature corrected reading modes (TC) in the Mark III, are based upon sucrose temperature correction factors developed by ICUMSA. Non-sucrose solutions will have unique temperature correction factor.

Since most uses of a refractometer is to control concentration, it is useful to eliminate the temperature effects when viewing instrument readings. One standard method is to have programmed custom channels that calculate the correct reading at 20 degrees C for a sample that is being read at other temperatures. The use of a custom channel allows comparing readings to a formula or process specification at a predetermined temperature without doing complicated conversions. Please note, that custom channels to do temperature correction, are specific to the material that the channel was developed for, and most likely will provide poor readings if used for a different material.

Computer Interface

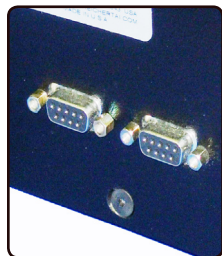


Fig 11

Baud Rate Selection	
Press READ to choose other port	
Press SELECT to exit	
REAR	FRONT
2400	1200
4800	2400
9600	4800
19200	9600
38400	19200
57600	38400

The Mark III includes two serial communications ports (Fig 11). Both are DB9 position female connectors that are located on the left side of the instrument. Data may be downloaded to a computer, and custom channel files can be uploaded to the refractometer or deleted through these ports. Regardless of which of the serial ports is chosen on the Mark III, communications with a computer is possible.

Any Windows® based computer can be used successfully when interfacing with the Mark III. Communication through software such as HyperTerminal or Tera Term is required. HyperTerminal is usually found on all Windows® based systems as a standard software option. Recommended communication settings of the serial port from the computer are: Baud rate 9600, 8 Data Bits, No Parity, 1 Stop Bit and Xon/Xoff Flow Control. Please note, that the Baud rate of the instrument must match that of the computer.

To connect the instrument to a computer use a compatible serial cable. Connection must be made while the instrument is turned off. To set up an output text string reference Printer Output.

Printer Interface

The printer output is provided for connecting an external printer through either of the two RS232 serial ports. Both are DB9 position female connectors. In order to communicate properly with a printer, a Null Modem cable must be used and should be connected while the instrument is turned off. Proper Baud rate selection of the RS232 serial port is also required, and should be set at 9600.

In order to set the output text string for the printer, computer interface is required. The options that exist for the output are as follows, and can be arranged according to individual requirements.

a = Temperature
b = Index
c = Index-TC
d = Solids
e = Solids-TC
f = Current Mode
g = Channel
h = Time
i = Date
j = ID
k = Method

Once communications with a computer is successful, type "sf" and press the enter key on the computer key board. This will display any current, text output string. To edit the string type sf, then a space and enter the desired letter codes. Example: **sf cagh**. With the example entry of **cagh** the instrument will print Index-TC, Temperature, Channel and Time.

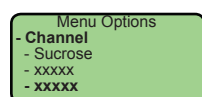
Custom Channel Activation

The Mark III has the capabilities to measure additional products using custom channels. These channels represent scales that have been developed to measure a specific product. Optional channels can be selected only after they have been uploaded from a PC to the Mark III. The following describes the Mark III custom channel possibilities.

Channel 1 – ICUMSA BRIX

The Mark III is pre-programmed at the factory with channel 1 to read % Sucrose or “Brix” scale per the International Commission for Uniform Methods of Sugar Analysis (ICUMSA). Temperature Corrected (TC) readings in channel 1 are valid for Sucrose only! This channel cannot be altered.

Channel 2 – 15, User Programmable



User programmable, or custom channels as they are commonly referred to, may be programmed using your own Refractive index, Temperature and percent Solids data. Custom channels can include definitions for units of measure such as specific gravity, % protein, g/ml, etc. To access and activate a stored custom channel advance to the Menu Options, Channel screen. Select from the displayed channel options and press the  key to activate the highlighted custom channel.

For a complete list of custom channels available from Reichert, please visit our web site at www.reichertai.com. Click on “Applications” and open the document titled “Custom Scales Available”. To learn more about custom channel programming, request “Custom Channel Generation for Automatic Refractometer Line” from Reichert Analytical technical support.

Uploading Custom Channels

To upload a custom channel, begin by connecting the Mark III to a computer as described under Computer Interface and follow the steps below.

- Once the connection to the computer has been made, type the command “autoplus” and press the return key on the computer key board.
- If the computer link is successful and the baud rates match appropriately the return on the computer display will be:
Enter -99 to erase all channels, -X to erase channel X, 0 to cancel or begin custom channel file upload
- Select **File**, then **Send File**, from the pull down menu located on the computer interface screen.
- Browse through your directories to locate the desired custom channel file to select it and select open to load file.
- To check that the file loaded correctly type Channeldata X. X represents the location of where the channel has been stored from 2 through 15. If successfully loaded the channel data will be displayed as it appears in the text file.
- To delete a stored custom channel, follow the instructions above and type “autoplus”. Remove files by typing -99 to remove all channels or -X to remove a specific file, and press the enter key on your computer key board.

Menu Options

Calibrate

Menu Options
- Calibrate
- Adjust Set Point
- Adjust Span Point
- Advanced Options
- Edit Data
- Restore Factory
- Exit

The Calibrate option provides two calibration choices and two advanced feature options. Once appropriate choices have been made, advance to Exit and press **SELECT** to return to Menu Options screen.

Adjust Set Point - Allows for a single set point calibration using distilled water. This option is covered in more detail under Set Point Calibration.

Adjust Span Point - Allows up to six additional calibration points to be used when performing a span point calibration. The proper use of this option is covered in more detail under Span Point Calibration.

Edit Data - This option allows the stored calibration values to be modified. Follow the on screen instructions pertaining to changing values, advancing and exiting this option.

Restore Factory - Restores original factory default settings. This option cannot be used as a substitute for an actual calibration procedure.

Channel

Menu Options
- Channel 1
- Sucrose

The option to select a channel is only available if a custom channel has been stored. To select any available channel, advance to Channel and press **SELECT**. All available channels will be displayed. Advance to desired channel and press **SELECT** to activate.

Mode

Menu Options
- Mode
- Index
- Index-TC
- Solids
- Solids-TC

The choice of four reading modes are available. Additional reading modes may be available if a custom channel is active. To change mode, select the required mode option and press **SELECT** to activate.

Index - Refractive index.

Index-TC - Refractive index temperature corrected.

Solids - Percent concentration (Brix).

Solids-TC - Percent concentration temperature corrected (Brix).

An alternate method of changing modes exists in the reading screen once a sample has been measured. All that is required is to press the **↓** or **↑** keys to advance through the available reading modes on the LCD screen.

Language

Menu Options
- Language
- English
- French
- Spanish
- German

English, French, Spanish and German are available language options. To activate one of these options, advance to the language of choice and press **SELECT**.

Automatic Temperature Equilibration

Menu Options
- Auto Temp. Equil.
- Off
- +/-0.01° C
- +/-0.02° C
- +/-0.03° C
- +/-0.04° C
- +/-0.05° C
- +/-0.06° C
- +/-0.07° C
- +/-0.08° C
- +/-0.09° C
- +/-0.10° C

Temperature equilibration of a sample to that of the refractometer is essential for accurate measurements. Automatic temperature equilibration will detect when the sample and prism have reached thermal stability. This option can either be turned off or set between +/-0.01°C to +/-0.10°C. A lower selected temperature value will increase the sensitivity and time for the sample to reach temperature stability. Some experimentation is required to determine the best setting for a specific application.

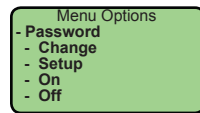
Sample Temperature
Stable

Align shadowline
and press READ

To properly use this feature apply the sample and press the **READ** key. After the Mark III displays that the temperature of the sample is stable, align the shadowline and press **READ** to attain the sample value.

Menu Options

Password



The purpose of a Password is to limit user access and protect features from being altered by anyone other than an administrator. Features that are deemed to be restricted may have their status changed to either Yes or No for Password protection by entering the Setup screen.

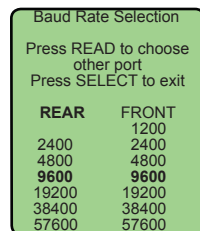
Protected Items	
- Calibrate	No
- Channel	No
- Mode	No
- Language	No
- Auto Temp. Equil.	No
- Password	Yes
- RS232 Baud	No
- Time	No
- Date	No
- Contrast	No
- ID	No

READ to change
↕ To select
SELECT to exit

To enter a Password advance to the Change screen. The first numeral will flash. Follow the displayed instructions on how to change, advance and exit. The Password option can be turned On or Off under the Password menu options.

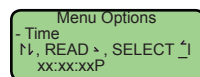
It is advisable that the password be recorded and secured in case it is forgotten. Once the Password is active it will not be possible to enter the protected Menu Options without it.

RS232 Baud



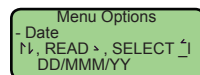
It is essential that the Baud rate be set properly for computer or printer communications. This option allows independent values to be set for each serial port. Please note that the REAR serial port must be set greater than or equal to the FRONT serial port. Please refer to the displayed instructions on how to change the Baud rate settings using the keys.

Time



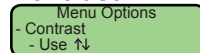
The time may be set in either AM/PM or 24:00:00 format. Use the or keys to change the displayed value. To advance to the next time segment use the key and the key to exit.

Date



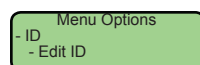
The Date format is DD/MMM/YY. Use the keys to change the displayed value. To advance to the next Date segment use the key and the key to exit.

Contrast



To adjust the display contrast use the keys. To exit, press the .

ID



The ID option is provided to enable tracking of individual users when the output is being sent to a computer or printer. Follow the displayed prompts to enter a user ID or contact Reichert technical support for greater details concerning this option.

Water Bath Attachment

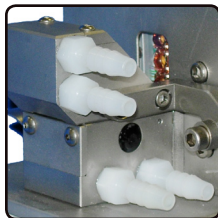


Fig 12

Certain testing applications may require the prism temperature to be maintained above or below ambient operating temperature. To accomplish temperature control, the Mark III is supplied with four water ports for connection to a water bath circulator (Fig 12). Commercial water bath circulators with heating, cooling or combined capabilities are generally available from laboratory instrument supply dealers.

Maximum head for water bath attachment should be 5 feet and maximum pressure 15 psi. The minimum operating temperature of Mark III is 10°C and maximum is 80°C.

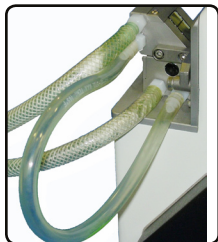


Fig 13

Using tubing having an inside diameter of .25 inches (6.4mm), connect the output hose from the water bath circulator to either of the water ports on the lower measuring prism assembly. Attach a second piece of tubing to the opposite water port, and connect it to either of the upper illuminating prism water ports. Ensure that this tubing is long enough to allow the upper illuminating prism assembly to open and close freely. Next attach the return hose for the water bath circulator to the remaining water bath port (Fig 13).

Tubing choice must consider flexibility. Any tubing that is highly rigid may apply excessive force on the prism preventing it from closing completely. This condition can adversely affect reading accuracy.

Note:

If a water bath circulator is attached, care must be used to avoid exposing the Mark III's prisms to thermal shock. The ambient prism temperature should be raised or lowered by gradually increasing or decreasing the temperature of the circulating fluid.

Due to the nature of refractometer thermal efficiency. Controlling the temperature of the instrument to a temperature above or below ambient, may require the water bath circulator temperature to be set higher or lower than the desired temperature of the Mark III. The exact temperature setting is dependent upon circulating fluid type, flow rate, ambient temperature, humidity, etc. Experimentation may be necessary to determine an appropriate water bath temperature setting to maintain a stable temperature at the Mark III. The instrument temperature as indicated in the lower left corner of the display, should be what dictates the water bath temperature setting.

When attempting to determine the appropriate water bath temperature setting. It may be helpful to have a distilled water sample on the prism to improve thermal conductivity between the upper and lower prism assemblies.

Care and Cleaning

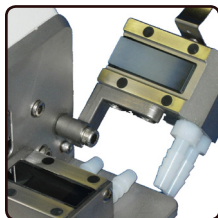


Fig 14

Preparing the prism surfaces for samples is essential if consistent and accurate values are to be attained. Prior to and immediately after a sample is placed on the prism surface, those surfaces must be properly cleaned (Fig 14). It is imperative that these surfaces be cleaned to assure removal of any possible residue since this condition will have an adverse affect on resultant readings. Never allow a sample to dry on the prism surfaces.

Depending upon the sample, clean the lower measuring prism and the upper illumination prism using distilled water, diluted soapy water, isopropyl alcohol or methanol. Rinse with distilled water and gently dry using a lint free product like Kim Wipes® that will leave no residue.

To properly clean the body or display areas of the instrument simply wipe with a soft cloth and a mild soap and water solution. A typical house hold glass cleaning product works well.

Cleaning Precautions

The sealant used between the prism and stainless steel block may be attacked by certain chemicals. Reichert recommends avoiding strong solvents such as N,N-Dimethylformamide or N,N-Dimethylacetamide, Tetrahydrofuran, cresols, phenols, and other tar acids. Some lacquer thinners can also deteriorate the seal over time or when used at elevated temperatures. To determine if your samples or solvents may attack this seal, please contact Reichert Analytical technical support.

Scratched optical surfaces can have an adverse effect on shadowline clarity. In the case of a sample having been allowed to dry on the prism surfaces, never use abrasive materials to remove that sample. Instead redissolve the sample with an appropriate solvent to protect the prism surface from being scratched. Thick, sticky samples should be rinsed off with a suitable solvent to avoid possibly scratching the prism. Use caution when removing samples or drying the prism.

Accessories

Catalog No. 13981000
Catalog No. 13982000
Catalog No. 13107040-901
Catalog No. 13981000-103

Printer, 110 VAC
Printer, 220 VAC
Null Modem Cable
Paper, 5 Rolls

Catalog No. WFAG20047

FUSE, 800mA, 250V, 5X20MM

Catalog No. 13K41330
Catalog No. 13K41340
Catalog No. 13K41350
Catalog No. 13K41360
Catalog No. 13K41370
Catalog No. 13K41380
Catalog No. 13K41390

NIST Certified Calibration Oil, 1.514XX
NIST Certified Calibration Oil, 1.402XX
NIST Certified Calibration Oil, 1.457XX
NIST Certified Calibration Oil, 1.489XX
NIST Certified Calibration Oil, 1.572XX
NIST Certified Calibration Oil, 1.630XX
NIST Certified Calibration Oil, 1.360XX
Above values will vary due to supplier of oil and lot numbers, editing the stored values in the refractometer may be required.

Catalog No. 13104520

Bromonaphthalene (Used as contact fluid when measuring solid samples)

Warranty and Non-Warranty Service

The warranty period for this instrument is two years against manufacturing defects. Please visit our web site at www.reichertai.com and select "Terms and Conditions of Sale" for an explanation of the warranty.

The Mark III refractometer is a precision instrument. Only Reichert factory-trained service technicians should perform repairs to assure proper functionality and sustained precision. If service is required, please contact our Reichert Service Department at Reichert Analytical Division headquarters in Buffalo, New York, USA, 716-686-4500 (Country Code 001), or our service facility located in Seefeld Germany at +49-8152-993530.



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